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THE EXTINCT SIRENIA.

BY E. D. COPE.

THE Sirenia occupy an especial place in the mammalian economy, which is only shared by the seals. They are denizens of the coasts of the sea and its branches, and of the larger rivers. Their present distribution differs from that of the seals in that it especially includes the tropics, where seals are rare; and excludes the polar regions, where seals abound. Extinct forms occur, however, in all the northern temperate regions that have been explored, and there is no reason to doubt that the order was of world-wide distribution during the early and middle parts of Cænozoic time.

The derivation of the Sirenia is shrouded in mystery. They have evidently diverged from land mammals of primitive placental type, and have become specialized in accordance with their peculiar modes of life, and have in many respects degenerated. Rudiments of pelvis and posterior limbs are present in most of them, and they are especially large in some species of the extinct genus Halitherium. Part of such a pelvis from South Carolina is represented in Plate XXV, Fig. 6. The dentition has become more and more reduced, till the enamel layer is lost in Halicore, and the teeth have all disappeared in Rhytina. The least generalized form is Prorastomus Owen, of which remains of a single species (*P. sirenoides*) have been found in the late Cænozoic beds of certain islands of the West Indies. Here the dentition is stated by Lydekker to be: I. $\frac{3}{3}$; C. $\frac{1}{1}$; M. $\frac{8}{8}$?.

The families of this order are the following:

Incisors present in normal number; canines present; molars numerous, rooted, and enamel-covered;	*Prorastomidæ.*
Incisors, in less than normal number; no canines; molars in normal number, rooted, and enamel-covered;	*Halitheriidæ.*
No incisors; molars present, covered with enamel, and in increased number;	*Manatidæ.*
Incisors present; molars prismatic, without enamel, and in reduced number;	*Halicoridæ.*
Teeth none;	*Rhytinidæ.*

The PRORASTOMIDÆ includes but the one genus, Prorastomus Owen, and this the single species *P. sirenoides* Owen. This is a highly interesting form, having a dentition intermediate between that characteristic of other members of the order and the typical mammalian formula. This is especially true in the normally constituted incisor and canine teeth. The molars are, like those of the manatees, cross-crested grinders, and in larger number than that normal to mammalia generally. The single species has been found in beds of uncertain but probably Eocene age in the West Indian Island of Jamaica.

The greater number of extinct Sirenia belong to the HALITHERIIDÆ, and they occur alike in the old world and in the new. The genera are as follows:

Incisors $\frac{2}{?}$; molars ?;	*Dioplotherium* Cope.
Incisors $\frac{1}{1}$; molars 6 or 7, the last superior the most complex; symphysis decurved, compressed;	*Halitherium* Kaup.
Incisors $\frac{1}{1}$; premolars, 3; molars, 4, the last superior reduced, simple;	*Miosiren* Dollo.
Incisors $\frac{?}{1}$; molars ?; symphysis long, not decurved, cylindric;	*Anoplonassa* Cope.

The incisors in the first three genera are tusk-like; in the last they are in the lower jaw, with short root, and are easily shed. Six or seven species of Halitherium are known from the Miocene and Pliocene beds of Western and Southern Europe. The

H. schinzii Kaup from the lower Miocene of Germany (Fig. 1*a*) is about as large as the manatee, while the *H. forrestii* Capellini is much larger, and is from the lower Pliocene of Italy. The *Miosiren kockii* Dollo is known from a skeleton from the Miocene of Belgium. It was rather larger than the manatee, and was nearest to the Halitheria. The principal difference is seen in the reduced last superior molar tooth, which shows indications of the reduction in number which took place in the dugong (Fig. 1*b*). The largest species supposed to belong to the family is the *Hemicaulodon effodens* Cope, from New Jersey, which is known from a large superior tooth only. The dentine of this tooth has regular transverse ridges, which are also traceable in a Halitherium (*H. capgrandi* Lart.), and it is covered by a layer of cementum. As the molar teeth are unknown, the reference of this animal to this family remains uncertain. The most primi-

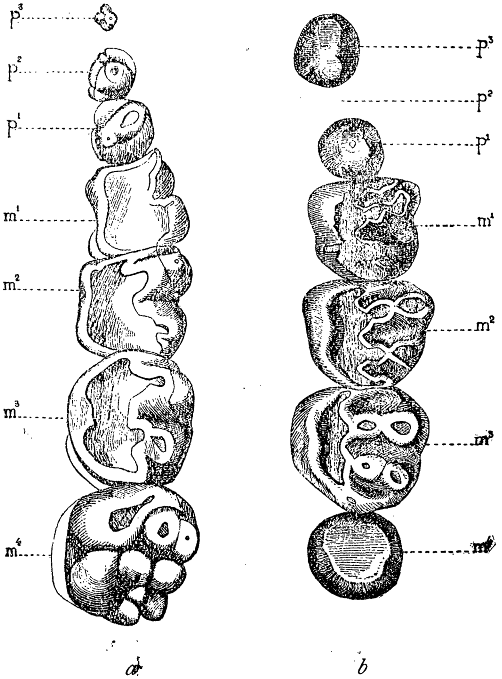


FIG. 1.—Dentition ot Halitheriidæ, two-thirds natural size, from Dollo. Fig. *a Halitherium schinzii*; *b*, *Miosiren kockii*.

tive form of the Halitheriidæ known is the genus Dioplotherium Cope, with two superior incisors. *D. manigaultii* is a large species which was found near Charleston, S. Carolina, by Dr. G. Manigault of that place (Plate XXV). The first incisor lacks the distal expansion of that of Halitherium. The molars are unknown.

Another and still more remarkable form has been discovered in the phosphatic deposits of South Carolina. This is the genus Anoplonassa Cope, in which the symphysis of one of the jaws is much elongated, is semi-cylindrical, and is not decurved as in the other members of the family. The premolar and molar teeth are shed at maturity, leaving indistinct traces, except, perhaps, the anterior incisor, which is represented by a large, shallow alveolus, and is perhaps not shed (Fig. 2). The muzzle is adapted to being inserted deep into mud in order to draw thence mollusca or other kinds of food. But one species is known, the *Anoplonassa forcipata* Cope. It is by no means certain that it belongs here, and it may be a Cetacean.

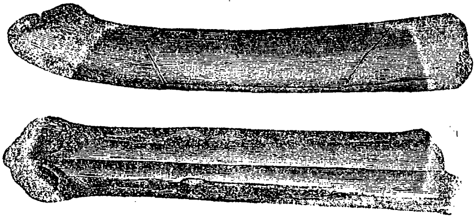
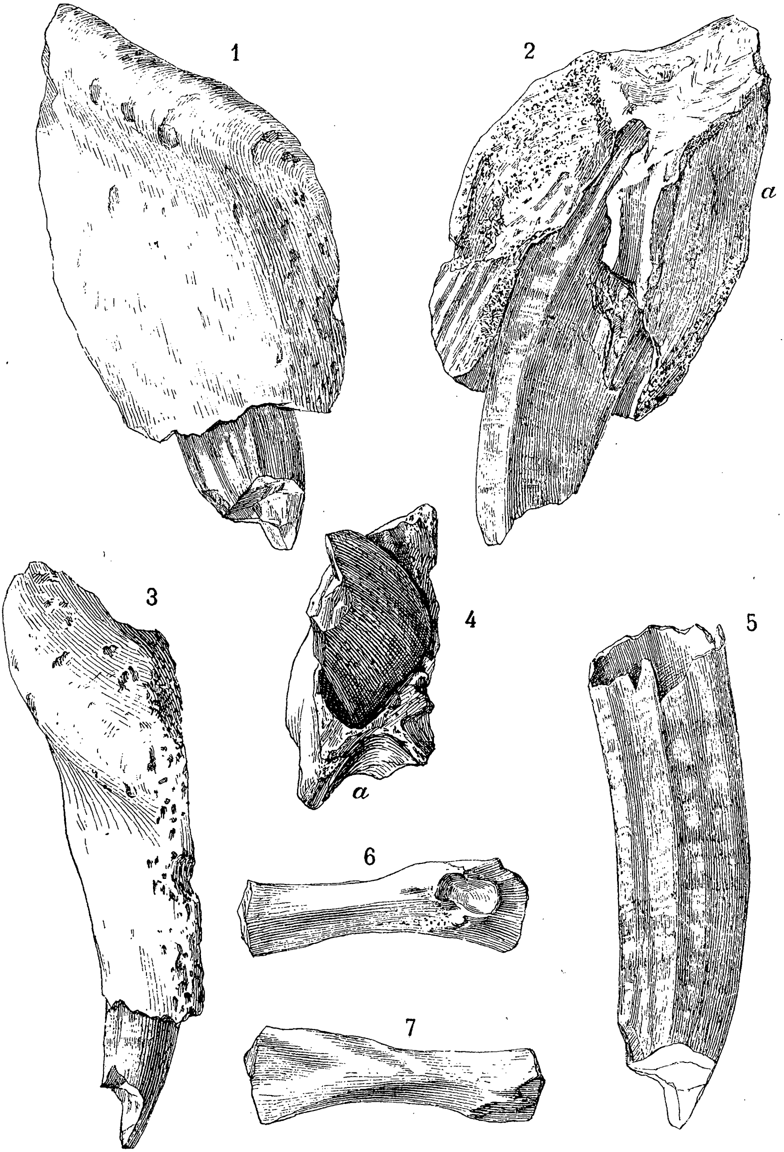


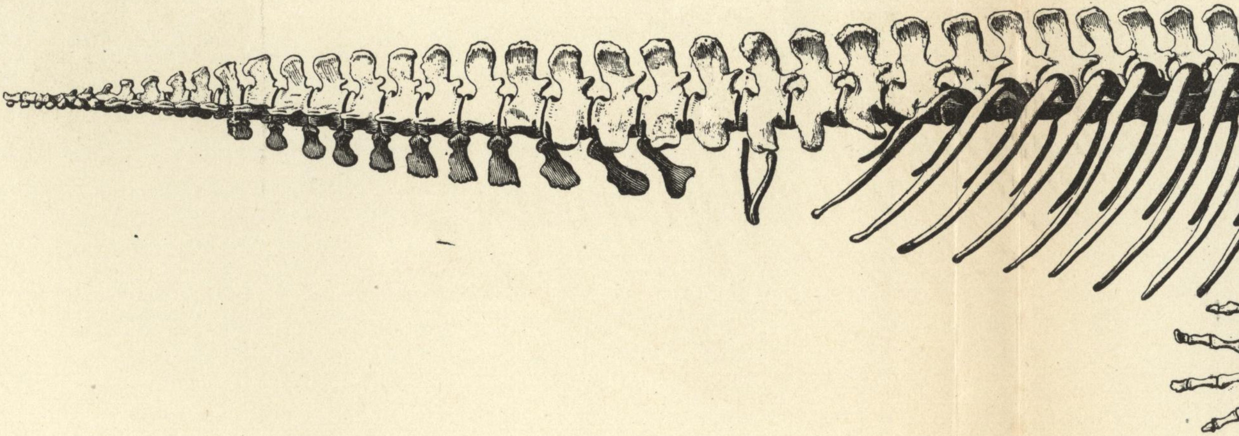
FIG. 2.—*Anoplonassa forcipata* Cope; one-fourth natural size. Original; from South Carolina.

The MANATIDÆ are remarkable for the number of their molars. In the genus Manatus there are eight in the permanent dentition, and a ninth anterior tooth, which is early shed. These molars are all alike, and with two transverse crests in the upper jaw and three in the lower. There is a minute incisor in the upper jaw, which is shed early. Besides the three living species of Manatus but few extinct species are known. Teeth resembling those of the Floridan species have been found in the Charleston deposits, and have been named by Leidy *M. fossilis*. A form from the Eocene of Egypt has been named by Owen *Eotherium egyptiacum*. Filhol does not distinguish the molars from those of Manatus as to their structure, but their number is unknown.

PLATE XXV.

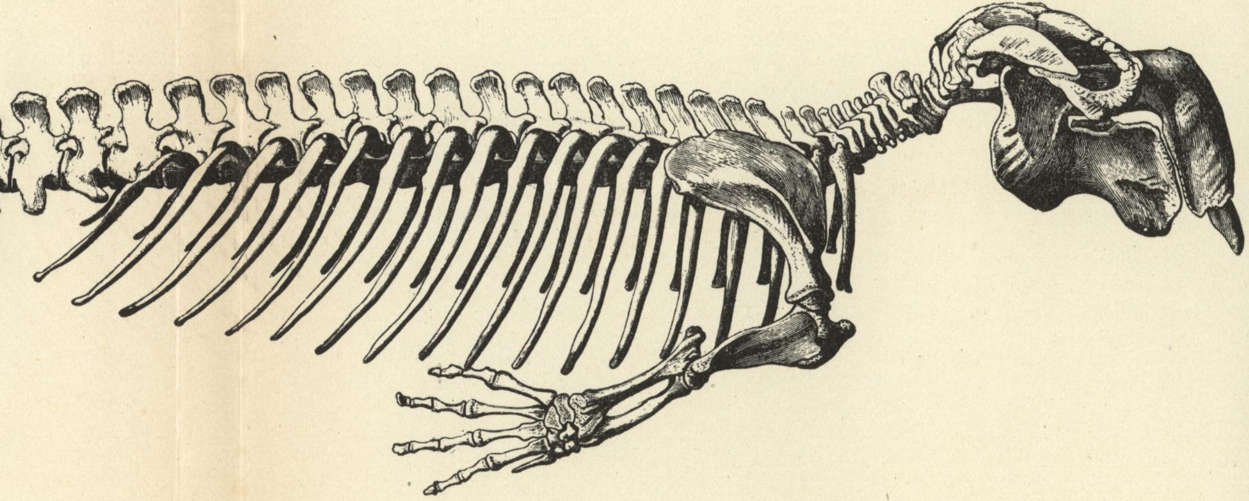


Dioplotherium manigaultii Cope.



Halicore dugong Cuv.

PLATE XXVI.



Halicore dugong Cuv.

Fossil HALICORIDÆ are unknown, except some bones of very

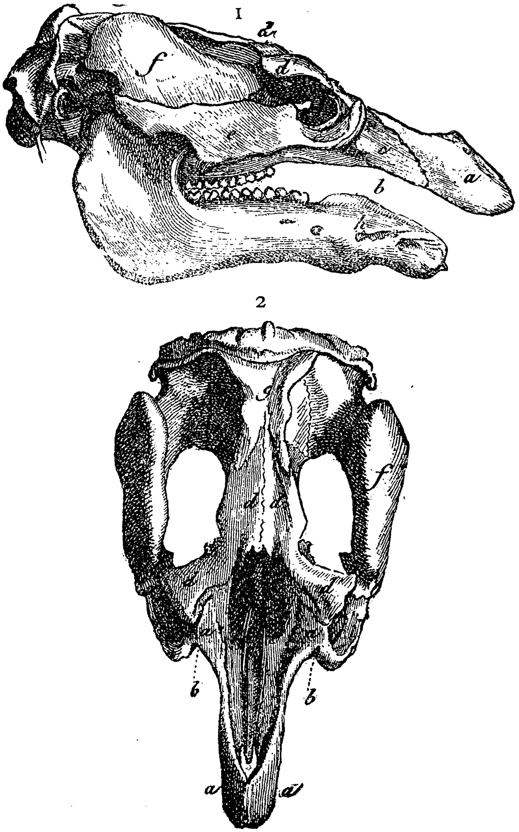
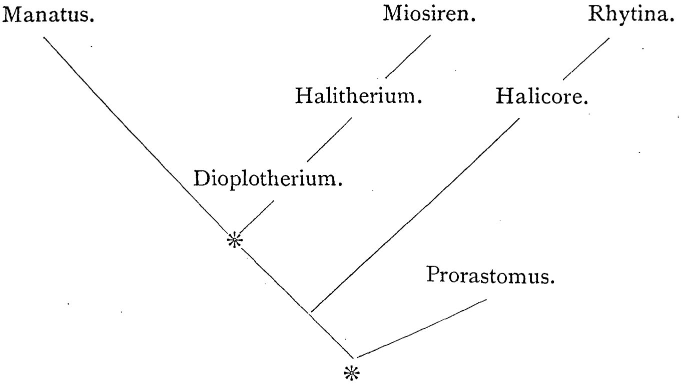


FIG. 3.—*Manatus americanus* Cuv.; skull one-twelfth natural size; from Cuvier. 1, ight side; 2, from above. *a*, Premaxillary bone; *b*, foramen infrantitole; *c*, maxillary; *d*, frontal; *e*, molar; *f*, zygomatic process of temporal; *g*, parietal.

late Tertiary age found in Australia. In the existing genus the dental formula is I. $\frac{1}{0}$; C. $\frac{0}{0}$; M. $\frac{2}{2}$, and the molars are prismatic and of cylindric or oval section, as in some Edentata. (Plate XXVI.) The RHYTINIDÆ are represented thus far by the typical genus and species only, the *R. gigas* Zimm., which dwelt on the coasts of Behring Sea up to a late period of human history. It is one of the large species of mammalia exterminated by man, and its bones are found in considerable abundance on Behring's Island, Commander's Island, etc. Nearly complete skeletons are preserved in the Museums of St. Petersburg, London, and Washington.

The lines of descent of the Sirenia may be expressed as follows:



EXPLANATION OF PLATES.

PLATE XXV.—*Dioplotherium manigaultii* Cope. Three-eighths natural size. Figs. 1–4, part of premaxillary bone with incisor alveoli, and I. 1 in place; 1 outside; 2 inside; 3 front; 4 from below; *a* alveolus of external incisor. Original; from type in Museum of Charleston, S. C. Figs. 6–7, os innominatum of unknown Sirenian, from Charleston. Reduced.

PLATE XXVI.—*Halicore dugong* Cuv. Skeleton, from Cuvier.

THE CONCRESCENCE THEORY OF THE VERTEBRATE EMBRYO.

BY CHARLES-SEDGWICK MINOT.

(Continued from page 629.)

Blastodermic Vesicle with Two Layers.—Of this stage we have several descriptions; for the rabbit by Kölliker (Grundriss, p. 89), Hensen, *24*, C. Rabl, *44*, 141, as well as the older accounts by Bischoff, *6*, and Coste, *14*, and the brief mention by Heape in Foster and Balfour's Embryology, 2d edition, 316–320; for the mole by Heape, *23;* for the dog by Bischoff, *7;* for the cat by Schäfer, *52;* for the sheep by Bonnet, *10;* and for several rodents as indicated in the section on inversion of the germ layers, p. 711.